

**SUBJECT:** Sterigenics, Willowbrook, IL: Ethylene Oxide Air Monitoring

**PREPARED BY:**  
Jacqueline Nwia  
Environmental Scientist  
Air Monitoring and Analysis Section  
Region 5

**FIELD MONITORING CONDUCTED BY:**  
Jacqueline Nwia  
Environmental Scientist  
Air Monitoring and Analysis Section  
Region 5

Margaret Sieffert  
Environmental Scientist  
Toxics and Global Atmospheres Section  
Region 5

**FIELD MONITORING REQUESTED BY:**  
Alexis Cain  
Section Chief  
Toxics and Global Atmospheres Section  
Region 5

**DATES OF FIELD MONITORING:** May 16-18, 2018

**REPORT AUTHORIZED BY:**  
  
Michael Compher  
Supervisor  
Air Monitoring and Analysis Section  
Region 5

**STERIGENICS, WILLOWBROOK, IL: ETHYLENE OXIDE AIR MONITORING**

*This page left intentionally blank*

## STERIGENICS, WILLOWBROOK, IL: ETHYLENE OXIDE AIR MONITORING

Methods Discussion .....	4
Table 1: All Results Table .....	5
Table 2: 12-hr Composite Sample Results.....	7
Table 3: Grab Sample Results.....	7

Figure 1: Time Series Plot: All Data .....	9
Figure 2: Results Clustered by Sampling Event (day/time) .....	10
Figure 3: May 16, 2018: 12-hr Daytime Composite Results with Meteorological Data .....	11
Figure 4: May 16, 2018: Grab Sample Results with Meteorological Data .....	11
Figure 5: May 16-17, 2018: 12-hr Overnight Composite Results with Meteorological Data .....	12
Figure 6: May 17, 2018: 12-hr Daytime Composite Results with Meteorological Data .....	12
Figure 7: May 17, 2018: Mid-morning Grab Sample Results with Meteorological Data .....	13
Figure 8: May 17, 2018: Mid-afternoon Grab Sample Results with Meteorological Data .....	13
Figure 9: May 17-18, 2018: 12-hr Overnight Composite Results with Meteorological Data .....	14

Methods:

US EPA Region 5 (R5) utilized the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition Compendium Method TO-15 Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/ Mass Spectrometry (GC/MS) (TO-15) for analyzing samples collected in the area near Sterigenics in Willowbrook, IL. The method entails collecting 12-hour composite or grab ambient air samples in SUMMA canisters, which were prepared by a contract laboratory (Eastern Research Group (ERG) through EPA's national air toxics contract. Once samples were collected, the canisters containing the sampled air were shipped to ERG for ethylene oxide (EtO) analysis using GC/MS.

To aid in the assessment of EtO concentrations, a portable meteorological tower was installed on the roof of a nearby building [REDACTED] @ 600 Joliet Road, Willowbrook, IL). The meteorological tower collected 5-minute wind speed and wind direction values. The latitude/longitude location of each sample, either 12-hour composite or grab, was recorded using latitude/longitude points obtained through a mobile phone compass application. A sampling plan and Quality Assurance Project Plan (QAPP) were developed for this project. Additional information can be found in the sampling plan (2018May10-EtOssamplingPlan) and Quality Assurance Project Plan (Sterigenics\_QAPP\_1.0).

In accordance with the QAPP, ambient EtO concentrations are compared to the minimum detection limit (MDL) which was determined by ERG to be 0.082 ug/m<sup>3</sup> (previously, the MDL was 0.0907 ug/m<sup>3</sup>). However, ERG calibrated and recalculated the MDL just prior to analyzing the canister samples from Willowbrook to 0.082 ug/m<sup>3</sup>), a concentration associated with an upper-bound lifetime probability of developing cancer of about 410 in a million if exposure occurred continuously at that concentration for 70 years. EPA's revised (2016) upper bound inhalation unit risk estimate of EtO cancer potency is 0.005<sup>1</sup> per ug/m<sup>3</sup>. R5 collected ambient air samples around the Sterigenics facility on May 16-18, 2018 to evaluate the concentrations of EtO.

Quality Assurance/Quality Control (QA/QC)

ERG adhered to QA/QC procedures established in their QAPP<sup>2</sup> which was approved by EPA on May 19, 2017. ERG's quality assured/controlled raw data results were provided to EPA in Excel spreadsheet format<sup>3</sup>. In addition to calibration checks and blank sample analysis, ERG performed replicate analysis of each duplicate sample collected in accordance with their QA/QC procedures. All results passed the QA/QC data analysis.

Data Validation

R5's Sterigenics project QAPP<sup>4</sup> requires data validation review by the QA Coordinator, Bilal Qazzaz, to determine whether DQOs are met. However, due to reassignment of work, Marta Fuoco, of the Air

<sup>1</sup> EPA/635/R-16/350Fa, [www.epa.gov/iris](http://www.epa.gov/iris). Evaluation of the Inhalation Carcinogenicity of Ethylene Oxide (CASRN 75-21-8) In Support of Summary Information on the Integrated Risk Information System (IRIS). December 2016, National Center for Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency, Washington, DC.

<sup>2</sup> Support for the EPA National Monitoring Programs (UATMP, NATTS, CSATAM, PAMS, and NMOC Support) Contract No. EP-D-14-030 2017 Quality Assurance Project Plan Category 1.

<sup>3</sup> Eto may 18 voc.xls file sent from [REDACTED] (ERG) to U.S. EPA on May 30, 2018.

<sup>4</sup> Quality Assurance Project Plan; Sterigenics, Willowbrook, Illinois Ethylene Oxide Air Monitoring Study (Sterigenics\_QAPP\_1.0)

## STERIGENICS, WILLOWBROOK, IL: ETHYLENE OXIDE AIR MONITORING

Monitoring and Assessment Section (AMAS) conducted the data validation review<sup>5</sup>. Data validation procedures identified two invalid data points, specifically, 2 collocated data points (LABSAMPIDs 8051813-08 and 8051813-09) collected on May 16, 2018 (0.158 ug/m<sup>3</sup> and 0.405 ug/m<sup>3</sup>) which didn't meet the acceptance criteria of  $\leq$  30% relative percent difference (RPD) or 5 times the MDL. These 2 data points had an RPD of over 87% (See tables in Appendix A). The 0.158 ug/m<sup>3</sup> value was the lowest sample value collected during this sampling campaign, and it is more challenging for low concentration collocated measure values to meet the 30% RPD criteria.

### Data Quality Objectives

The primary objective of ambient air monitoring was to determine whether ethylene oxide is detectable near the Sterigenics facility. Other objectives were to determine how the ambient levels [REDACTED] [REDACTED] more refined AERMOD modeled concentrations<sup>6</sup>. Data is of sufficient quantity and quality to address these questions.

Data quality objectives (DQO) and criteria are identified in the QAPP as follows:

1. Data completeness is 75% of total samples.
  - a. Although 2 data points were invalidated out of the total 19 12-hour composite samples, 17 were validated, exceeding the 75% DQO established in the QAPP
  - b. All 17 grab samples were validated, exceeding the 75% DQO established in the QAPP.
  - c. All samples exceed the ERG's MDL of 0.082 ug/m<sup>3</sup>.
  - d. Despite shifting winds, review of the data concludes that sufficient downwind samples were collected.

Quality assurance, quality control and data quality objectives and criteria are met with the sampling and analysis conducted for this study.

### Results

The tables, graphs and maps below present and illustrate the data and results collected May 16-18, 2018. Table 1 presents all samples and EtO concentrations collected for this study while Tables 2 and 3 separate the 12-hour composite and grab samples. EtO concentrations above the MDL were measured for all 12-hour composite and grab samples.

**Table 1: All Results Table (QX=Invalidated data: Failed QC Criteria)**

Sampling Date	Sampling Time	Canister Number	Sample Duration	EtO (ug/m <sup>3</sup> )	Detection Limit (ug/m <sup>3</sup> )
5/16-17/2018	6:41PM - 6:20AM	A21042	11 hrs 39 min	9.09	0.164
5/16-17/2018	6:41PM - 6:20AM	SAT027	11 hrs 39 min (duplicate)	8.33	0.164
5/17/2018	7:27AM - 6:52PM	19650	11 hrs 25 min	8.236	0.082
5/17-18/2018	6:58PM - 6:37AM	18827	11 hrs 39 min	4.94	0.082
5/17/2018	6:54AM - 6:15PM	19662	11 hrs 21 min	4.56	0.082
5/16/2018	1:26 PM	SAT085	Grab	4.34	0.082
5/16/2018	1:12 PM	5132	Grab	4.27	0.082

<sup>5</sup> Deviations from Sterigenics QAPP, Memorandum from Jacqueline Nwia to Bilal Qazzaz, July 3, 2018

<sup>6</sup> [REDACTED] More refined AERMOD modeling was performed by Region 5's Air Toxics and Assessment Branch staff based on estimated inputs.

**STERIGENICS, WILLOWBROOK, IL: ETHYLENE OXIDE AIR MONITORING**

Sampling Date	Sampling Time	Canister Number	Sample Duration	EtO (ug/m <sup>3</sup> )	Detection Limit (ug/m <sup>3</sup> )
5/16-17/2018	7:01PM - 6:59AM	19641	11 hrs 58 min	3.87	0.082
5/17-18/2018	6:58PM - 6:37AM	5124	11 hrs 39 min (duplicate)	3.69	0.082
5/16/2018	7:21AM - 5:37PM	5142	10 hrs 16 min	3.55	0.082
5/16/2018	12:50 PM	SAT169	Grab (duplicate)	2.28	0.082
5/16/2018	12:50 PM	A21056	Grab	2.17	0.082
5/16-17/2018	7:28PM - 7:12AM	19652	11 hrs 44 min	2.12	0.082
5/16/2018	12:37PM	SAT094	Grab	1.57	0.082
5/17/2018	2:46 PM	SAT009	Grab	1.34	0.082
5/17/2018	10:42 AM	5052	Grab (duplicate)	1.04	0.082
5/17/2018	10:42 AM	SAT173	Grab	1.02	0.082
5/17/2018	6:29AM - 5:53PM	5017	11 hrs 24 min	1.01	0.082
5/17/2018	7:16AM - 6:23PM	18864	11 hrs 7 min	0.979	0.082
5/17/2018	2:33 PM	SAT034	Grab	0.936	0.082
5/17/2018	7:07AM - 6:30PM	5100	11 hrs 23 min	0.867	0.082
5/17/2018	6:29AM - 5:53PM	19290	11 hrs 24 min (duplicate)	0.789	0.082
5/16-17/2018	7:13PM - 7:01AM	SAT074	11 hrs 48 min	0.659	0.082
5/16/2018	7:37AM - 5:50PM	5090	10 hrs 13 min	0.518	0.082
5/17/2018	10:53 AM	A21012	Grab	0.494	0.082
5/16/2018	7:50AM - 5:44PM	SAT007	9 hrs 44 min	0.463	0.082
5/17/2018	2:53 PM	5072	Grab	0.447	0.082
5/17/2018	10:59 AM	5053	Grab	0.411	0.082
5/17/2018	10:20 AM	SAT095	Grab	0.405	0.082
5/16/2018	6:56AM - 5:12PM	SAT166	10 hrs 16 min	QX	0.082
5/16/2018	1:04 PM	SAT061	Grab	0.355	0.082
5/17/2018	10:32 AM	SAT133	Grab	0.338	0.082
5/17-18/2018	6:43PM - 6:29AM	5101	11 hrs 46 min	0.338	0.082
5/17/2018	10:33 AM	A21065	Grab	0.291	0.082
5/17/2018	2:36 PM	SAT101	Grab	0.243	0.082
5/16/2018	12:29PM	19644	Grab	0.221	0.082
5/17/2018	2:27 PM	19294	Grab (duplicate)	0.214	0.082
5/17/2018	3:05 PM	SAT020	Grab	0.206	0.082
5/17/2018	2:59 PM	19651	Grab	0.174	0.082
5/17/2018	2:27 PM	18875	Grab	0.163	0.082
5/16/2018	6:56AM - 5:09PM	19277	10 hrs 13 min (duplicate)	QX	0.082

STERIGENICS, WILLOWBROOK, IL: ETHYLENE OXIDE AIR MONITORING

**Table 2: 12-hr Composite Sample Results (QX=Invalidated data: Failed QC Criteria)**

Sampling Date	Sampling Time	Canister Number	EtO (ug/m <sup>3</sup> )	Detection Limit (ug/m <sup>3</sup> )
5/17/2018	7:27AM - 6:52PM	19650	8.236	0.082
5/17/2018	6:54AM - 6:15PM	19662	4.56	0.082
5/16-17/2018	7:01PM - 6:59AM	19641	3.87	0.082
5/16/2018	7:21AM - 5:37PM	5142	3.55	0.082
5/16-17/2018	7:28PM - 7:12AM	19652	2.12	0.082
5/17/2018	7:16AM - 6:23PM	18864	0.979	0.082
5/17/2018	7:07AM - 6:30PM	5100	0.867	0.082
5/16-17/2018	7:13PM - 7:01AM	SAT074	0.659	0.082
5/16/2018	7:37AM - 5:50PM	5090	0.518	0.082
5/16/2018	7:50AM - 5:44PM	SAT007	0.463	0.082
5/17-18/2018	6:43PM - 6:29AM	5101	0.338	0.082
5/16-17/2018	6:41PM - 6:20AM	A21042	9.09	0.164
5/16-17/2018	6:41PM - 6:20AM	SAT027	8.33	0.164
5/17-18/2018	6:58PM - 6:37AM	18827	4.94	0.082
5/17-18/2018	6:58PM - 6:37AM	5124	3.69	0.082
5/17/2018	6:29AM - 5:53PM	5017	1.01	0.082
5/17/2018	6:29AM - 5:53PM	19290	0.789	0.082
5/16/2018	6:56AM - 5:12PM	SAT166	QX	0.082
5/16/2018	6:56AM - 5:09PM	19277	QX	0.082

**Table 3: Grab Sample Results**

Sampling Date	Sampling Time	Canister Number	EtO (ug/m <sup>3</sup> )	Detection Limit (ug/m <sup>3</sup> )
5/16/2018	12:50 PM	SAT169	2.28	0.082
5/16/2018	12:50 PM	A21056	2.17	0.082
5/17/2018	10:42 AM	5052	1.04	0.082
5/17/2018	10:42 AM	SAT173	1.02	0.082
5/17/2018	2:27 PM	19294	0.214	0.082
5/17/2018	2:27 PM	18875	0.163	0.082
5/16/2018	1:26 PM	SAT085	4.34	0.082
5/16/2018	1:12 PM	5132	4.27	0.082
5/16/2018	12:37PM	SAT094	1.57	0.082
5/17/2018	2:46 PM	SAT009	1.34	0.082
5/17/2018	2:33 PM	SAT034	0.936	0.082
5/17/2018	10:53 AM	A21012	0.494	0.082
5/17/2018	2:53 PM	5072	0.447	0.082

**STERIGENICS, WILLOWBROOK, IL: ETHYLENE OXIDE AIR MONITORING**

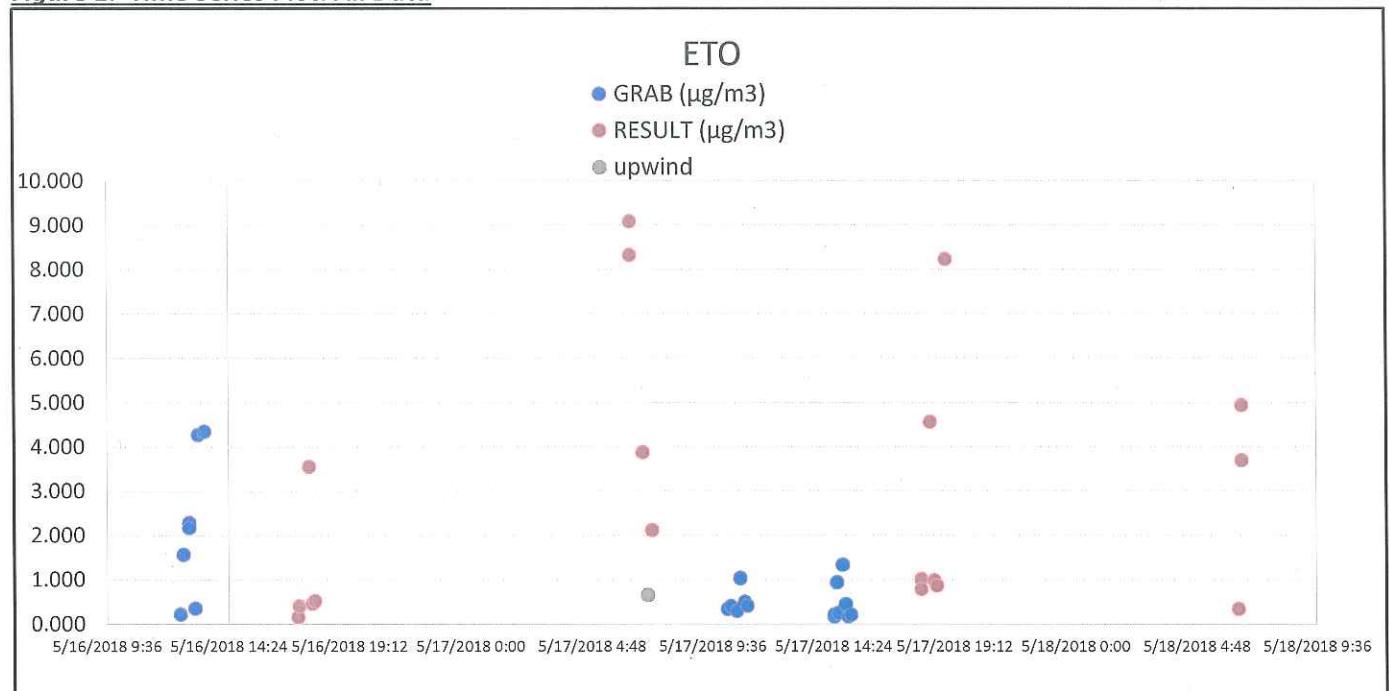
Sampling Date	Sampling Time	Canister Number	EtO (ug/m <sup>3</sup> )	Detection Limit (ug/m <sup>3</sup> )
5/17/2018	10:59 AM	5053	0.411	0.082
5/17/2018	10:20 AM	SAT095	0.405	0.082
5/16/2018	1:04 PM	SAT061	0.355	0.082
5/17/2018	10:32 AM	SAT133	0.338	0.082
5/17/2018	10:33 AM	A21065	0.291	0.082
5/17/2018	2:36 PM	SAT101	0.243	0.082
5/16/2018	12:29PM	19644	0.221	0.082
5/17/2018	3:05 PM	SAT020	0.206	0.082
5/17/2018	2:59 PM	19651	0.174	0.082

The figures below were created using Excel and Geoplatform GIS application. Figure 1 is a time series plot illustrating grab and 12-hour composite samples throughout the sampling period. Figure 2 presents results for 12-hour composite and grab samples clustered by event (day/time). The maps illustrate each sampling event with the corresponding wind speed/wind direction plots. Figures 3-9 demonstrate the following:

- In general, predominant daytime winds were from the northeast resulting in higher ambient concentrations measured downwind of Sterigenics (southwest of the facility) (Figures 3,4,6,7 and 8).
- In general, predominant overnight winds were light and variable resulting in some of the highest concentrations measured closer to the facility (@ Willowbrook building) (Figures 5 and 9).
- As noted previously, all samples resulted in concentrations well above the MDL.
- The monitored ambient concentrations coupled with the wind roses demonstrate that Sterigenics is likely the source of the EtO detected in the ambient air since it is the largest source of EtO in the immediate area. The closest known other EtO sources are more than four miles away.

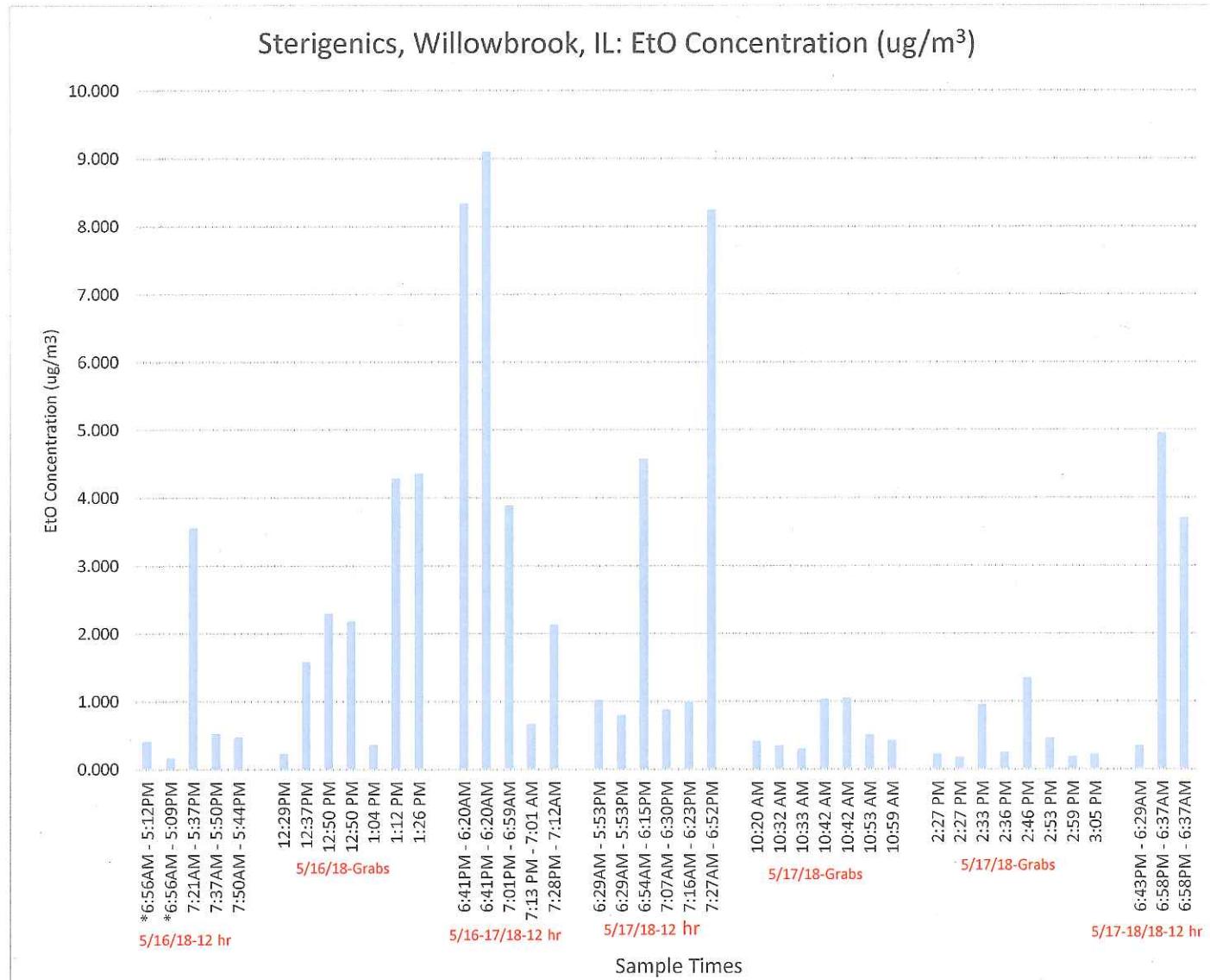
STERIGENICS, WILLOWBROOK, IL: ETHYLENE OXIDE AIR MONITORING

Figure 1: Time Series Plot: All Data



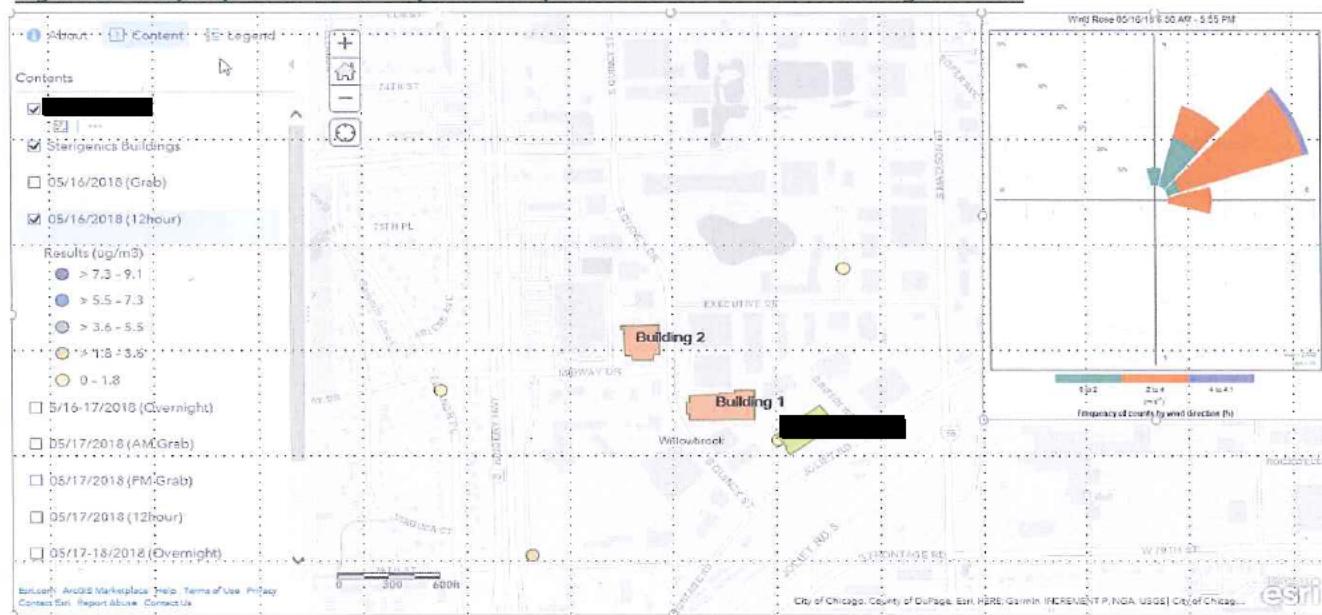
**STERIGENICS, WILLOWBROOK, IL: ETHYLENE OXIDE AIR MONITORING**

**Figure 2: Results Clustered by Sampling Event (Day/time)**



STERIGENICS, WILLOWBROOK, IL: ETHYLENE OXIDE AIR MONITORING

**Figure 3: May 16, 2018: 12-hr Daytime Composite Results with Meteorological Data**

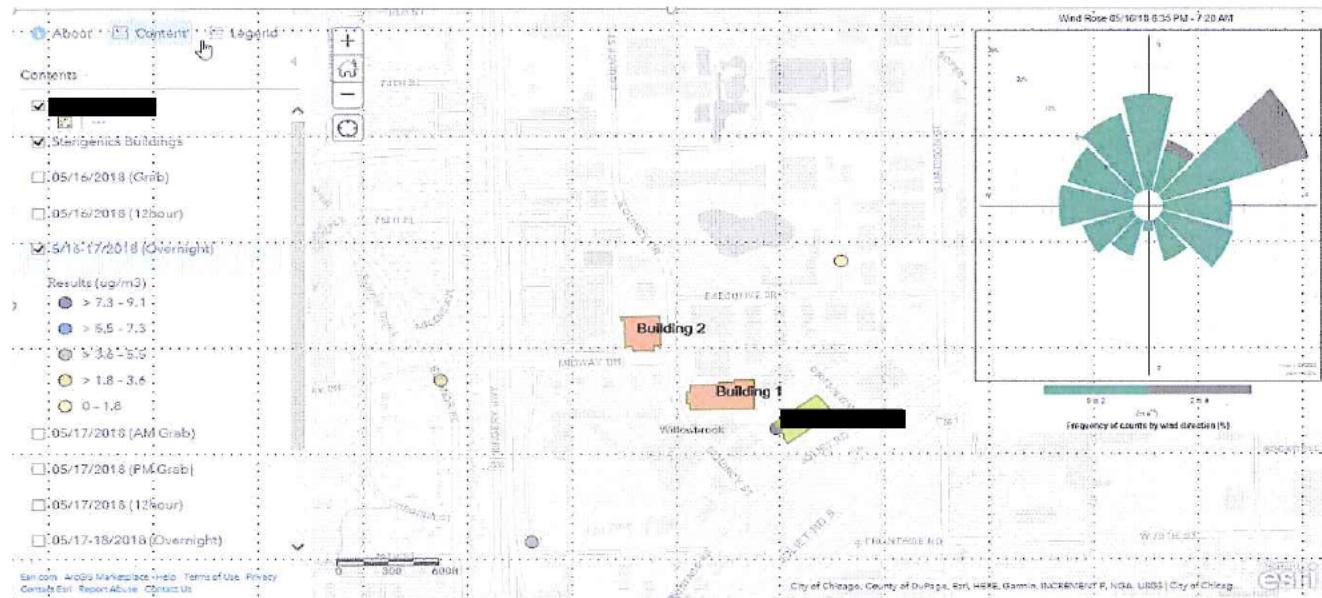


**Figure 4: May 16, 2018: Grab Sample Results with Meteorological Data**

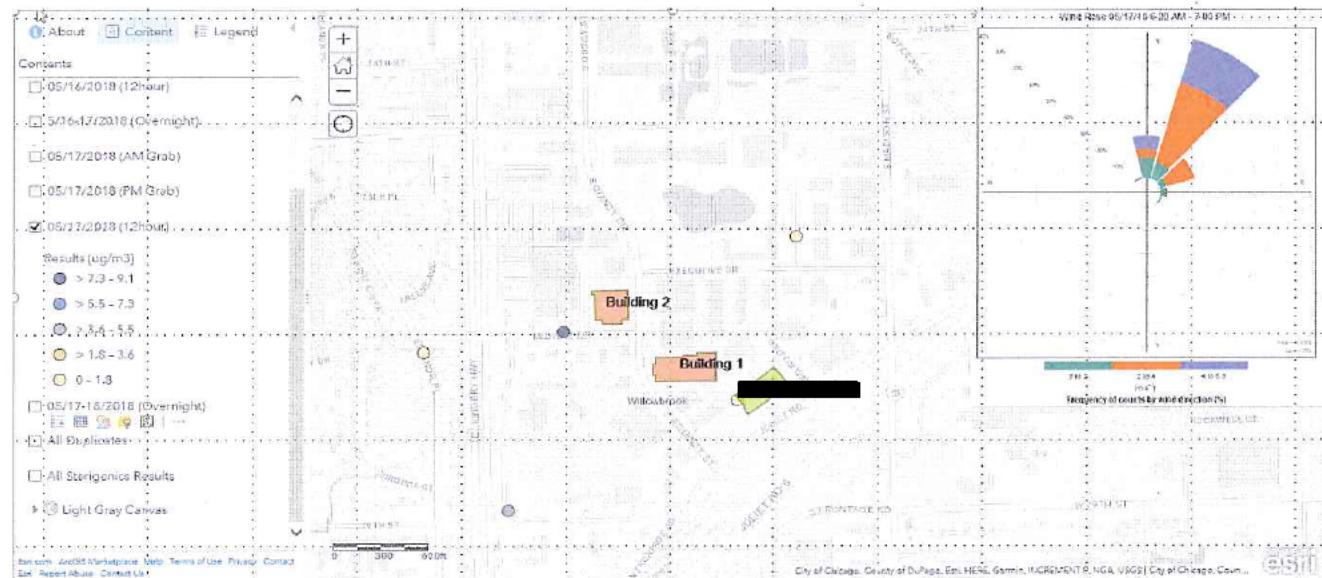


STERIGENICS, WILLOWBROOK, IL: ETHYLENE OXIDE AIR MONITORING

**Figure 5: May 16-17, 2018: 12-hr Overnight Composite Results with Meteorological Data**

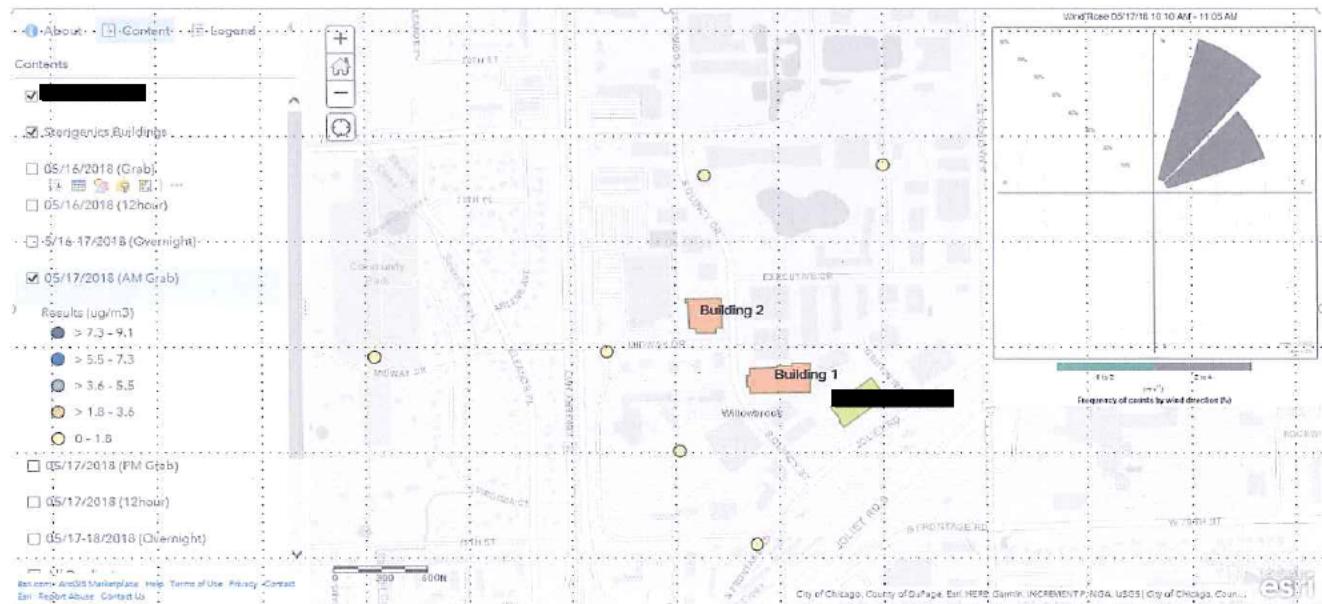


**Figure 6: May 17, 2018: 12-hr Daytime Composite Results with Meteorological Data**

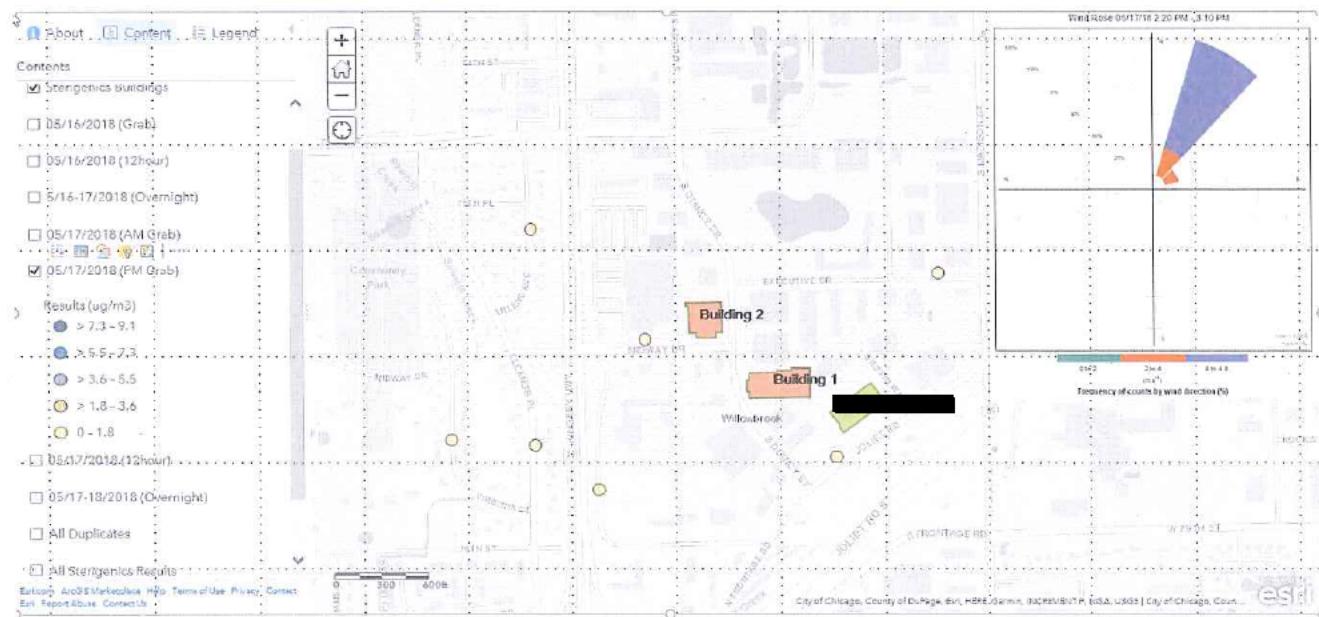


## STERIGENICS, WILLOWBROOK, IL: ETHYLENE OXIDE AIR MONITORING

**Figure 7: May 17, 2018: Mid-morning Grab Sample Results with Meteorological Data**



**Figure 8: May 17, 2018: Mid-afternoon Grab Sample Results with Meteorological Data**



STERIGENICS, WILLOWBROOK, IL: ETHYLENE OXIDE AIR MONITORING

**Figure 9: May 17-18, 2018: 12-hr Overnight Composite Results with Meteorological Data**



## Attachment A

SAMPLENAME	LABSAMPLEID	SAMPDATE	PREDATE	ANADATE	RESULT (ppbv)	ANOTE	DL (ppbv)	RESULT ( $\mu\text{g}/\text{m}^3$ )	ANOTE	DL ( $\mu\text{g}/\text{m}^3$ )	RPD ( $\frac{\text{ABS(L4-L5)}}{\text{R4}} \times 100$ )	Arith Mean	5x MDL	Acceptance criteria (DUP) <30% RPD for cpds > 5xMDL)
Eto Grab 41.7489,-87.9353	8051813-01	5/16/2018 12:30	5/16/2018 12:30	5/22/2018	0.122		0.0453	0.221		0.082				
Eto Grab 41.7471,-87.9420	8051813-02	5/16/2018 12:38	5/16/2018 12:38	5/22/2018	0.867		0.0453	1.57		0.082				
Eto Grab D1.41.7450,-87.9454	8051813-03	5/16/2018 12:51	5/16/2018 12:51	5/21/2018	1.26		0.0453	2.28		0.082	4.878	2.23	0.410	YES
Eto Grab D2.41.7450,-87.9454	8051813-04	5/16/2018 12:51	5/16/2018 12:51	5/21/2018	1.2		0.0453	2.17		0.082				
Eto Grab 41.7486,-87.9461	8051813-05	5/16/2018 13:05	5/16/2018 13:05	5/22/2018	0.196		0.0453	0.355		0.082				
Eto Grab 41.7490,-87.9423	8051813-06	5/16/2018 13:13	5/16/2018 13:13	5/22/2018	2.36		0.0453	4.27		0.082				
Eto Grab 41.7483,-87.9459	8051813-07	5/16/2018 13:27	5/16/2018 13:27	5/22/2018	2.4		0.0453	4.34		0.082				
Eto D1.41.7474,-87.9385	8051813-08	5/16/2018 17:09	5/16/2018 17:09	5/21/2018	0.0872		0.0453	0.158	QX	0.082	87.918	0.282	0.410	NO
Eto D2.41.7474,-87.9385	8051813-09	5/16/2018 17:12	5/16/2018 17:12	5/21/2018	0.224		0.0453	0.405	QX	0.082				
Eto 41.7453,-87.9439	8051813-15	5/16/2018 17:37	5/16/2018 17:37	5/22/2018	1.96		0.0453	3.55		0.082				
Eto 41.7505,-87.9371	8051813-17	5/16/2018 17:44	5/16/2018 17:44	5/22/2018	0.256		0.0453	0.463		0.082				
Eto 41.7483,-87.9459	8051813-10	5/16/2018 17:50	5/16/2018 17:50	5/22/2018	0.286		0.0453	0.518		0.082				
Eto D1.41.7474,-87.9385	8051813-11	5/17/2018 6:20	5/16/2018 18	5/22/2018	5.02	D	0.0906	9.09	D	0.164	8.732	8.706	0.820	YES
Eto D2.41.7474,-87.9385	8051813-12	5/17/2018 6:20	5/17/2018 6:20	5/22/2018	4.6	D	0.0906	8.33	D	0.164				
Eto 41.7453,-87.9439	8051813-16	5/17/2018 6:50	5/17/2018 6:50	5/22/2018	2.14		0.0453	3.87		0.082				
Ethylene Oxide Upwind 12hr														
41.7505,-87.9371	8051813-13	5/17/2018 7:01	5/17/2018 7:01	5/22/2018	0.364		0.0453	0.659		0.082				
Eto 41.7483,-87.9459	8051813-14	5/17/2018 7:12	5/17/2018 7:12	5/22/2018	1.17		0.0453	2.12		0.082				
Eto Grab 41.7519,-87.9373	8052134-04	5/17/2018 10:12	5/17/2018 10:12	5/23/2018	0.187		0.0453	0.338		0.082				
Eto Grab 41.7517,-87.9415	8052134-07	5/17/2018 10:20	5/17/2018 18	5/23/2018	0.224		0.0453	0.405		0.082				
Eto Grab 41.7484,-87.9493	8052134-01	5/17/2018 10:34	5/17/2018 10:34	5/23/2018	0.161		0.0453	0.291		0.082				
Eto Grab D1.41.7485,-87.9438	8052134-09	5/17/2018 10:42	5/17/2018 10:42	5/23/2018	0.564		0.0453	1.02		0.082	1.583	1.029	0.410	YES
Eto Grab D2.41.7485,-87.9438	8052134-10	5/17/2018 10:42	5/17/2018 10:42	5/23/2018	0.573		0.0453	1.04		0.082				
Eto Grab 41.7467,-87.9421	8052134-06	5/17/2018 10:53	5/17/2018 10:53	5/23/2018	0.273		0.0453	0.494		0.082				
Eto Grab 41.7450,-87.9403	8052134-15	5/17/2018 10:59	5/17/2018 10:59	5/23/2018	0.227		0.0453	0.411		0.082				
Eto Grab D1.41.7508,-87.9456	8052134-20	5/17/2018 14:27	5/17/2018 14:27	5/24/2018	0.0903		0.0453	0.163		0.082	26.596	0.189	0.410	YES
Eto Grab D2.41.7508,-87.9456	8052134-21	5/17/2018 14:27	5/17/2018 14:27	5/24/2018	0.118		0.0453	0.214		0.082				
Eto Grab 41.7469,-87.9455	8052134-19	5/17/2018 14:33	5/17/2018 14:33	5/24/2018	0.517		0.0453	0.936		0.082				
Eto Grab 41.7470,-87.9475	8052134-05	5/17/2018 14:36	5/17/2018 14:36	5/23/2018	0.134		0.0453	0.243		0.082				
Eto Grab 41.7461,-87.9440	8052134-02	5/17/2018 14:46	5/17/2018 14:46	5/23/2018	0.739		0.0453	1.34		0.082				
Eto Grab 41.7488,-87.9429	8052134-16	5/17/2018 14:53	5/17/2018 14:53	5/23/2018	0.247		0.0453	0.447		0.082				
Eto Grab 41.7500,-87.9360	8052134-17	5/17/2018 14:59	5/17/2018 14:59	5/24/2018	0.0961		0.0453	0.174		0.082				
Eto Grab 41.7467,-87.9384	8052134-03	5/17/2018 15:05	5/17/2018 15:05	5/23/2018	0.114		0.0453	0.206		0.082				
Eto D1.41.7474,-87.9385	8052134-22	5/17/2018 17:53	5/17/2018 17:53	5/24/2018	0.557		0.0453	1.01		0.082	24.371	0.899	0.410	YES
Eto D2.41.7474,-87.9385	8052134-23	5/17/2018 17:53	5/17/2018 17:53	5/24/2018	0.436		0.0453	0.789		0.082				
Eto 41.7453,-87.9439	8052134-08	5/17/2018 18:15	5/17/2018 18:15	5/23/2018	2.52		0.0453	4.56		0.082				
Eto 41.7483,-87.9459	8052134-18	5/17/2018 18:23	5/17/2018 18:23	5/24/2018	0.541		0.0453	0.979		0.082				
Eto 41.7505,-87.9371	8052134-24	5/17/2018 18:30	5/17/2018 18:30	5/24/2018	0.479		0.0453	0.867		0.082				
Eto 41.7487,-87.9426	8052134-14	5/17/2018 18:52	5/17/2018 18:52	5/23/2018	4.55		0.0453	8.236		0.082				

**STERIGENICS, WILLOWBROOK, IL: ETHYLENE OXIDE AIR MONITORING**

SAMPLENAME	LABSAMPLEID	SAMPID	SAMPLEDATE	PREPDATE	ANADATE	RESULT (ppbv)	DL (ppbv)	RESULT ( $\mu\text{g}/\text{m}^3$ )	DL ( $\mu\text{g}/\text{m}^3$ )	RPD ( $\text{ABS}(L4-L5)/R4 \times 100$ )	Arith Mean	5x MDL	Acceptance criteria (DUP) <30% RPD for cpds > 5xMDL
EtO 41.7519,-87.9327	8052134-13	5/18/2018 6:29	5/18/2018 6:29	5/18/2018	5/23/2018	0.187	0.0453	0.338	0.082				
EtO D1 41.7487,-87.9426	8052134-11	5/18/2018 6:37	5/18/2018 6:37	5/18/2018	5/23/2018	2.73	D-F	0.0453	4.94	D-F	0.082	28.931	4.32
EtO D2 41.7487,-87.9426	8052134-12	5/18/2018 6:37	5/18/2018 6:37	5/18/2018	5/23/2018	2.04	D-F	0.0453	3.69	D-F	0.082		0.440 YES

**Qualifier Codes:** D = This result obtained by dilution; D-F = Duplicate exceeds DQO criteria; QX = Invalidated data/Failed QC Criteria